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MSAPC ADVISORY CIRCULAR

U.S. ENVIRONMENTAL PROTECTION AGENCY

OFFICE OF AIR AND WATER PROGRAMS • OFFICE OF MOBILE SOURCE AIR POLLUTION CONTROL

A/C NO. 22A

April 3, 1973

PAGE 1 OF 18 PAGES

SUBJECT: Shipment of Heavy Duty Engines to EPA for Testing

A. Purpose

The purpose of this Advisory Circular is to supersede Advisory Circular No. 22, "Shipment of Heavy Duty Engines to EPA for Testing", to correct technical specifications and to revise sections based upon knowledge gained since the original issuance of the Circular. Advisory Circular No. 22 is obsolete and should be discarded.

B. Background

1. Sections 40 CFR 85.774-29, 85.874-29, and 85.974-29 authorize the Administrator to require that certain heavy duty engines be tested by EPA. To expedite the testing process at the Ann Arbor laboratory, heavy duty engines should be prepared for testing in the EPA facility. Advisory Circular No. 22 issued October 16, 1972, explained what needed to be done to prepare heavy duty engines for testing.

2. Since that time errors have been discovered, some items need to be clarified, and an additional requirement has been identified. Therefore, Advisory Circular No. 22 needs to be revised.

3. Revised sections include D.6 on page 2 and I.A.2 and I.B. 1 and 2 of Appendix A. An annotation for note 1 was also added to page 12 for clarification.

C. Applicability

The procedures discussed in this Advisory Circular shall be effective upon publication.

D. General Requirements

The provisions listed herein will facilitate EPA testing. Failure to follow any of these procedures may delay testing until the engine is prepared correctly.

1. All equipment supplied by the manufacturer shall be in good, safe working order, and designed according to standard engineering practices. EPA will

not test engines with equipment which is worn to an extent that it constitutes a hazard.

2. Engines shall be shipped in a manner which facilitates unloading. Specifically, engines shall be located in the rear of the van so that the engine can be removed by a forklift operating on the ground. (If the engine is not in the rear of the van, it, and all other items in the van, shall be so located that EPA can attach a chain to the skid, pull it to the rear without interference from any other items on the van, and then remove it with a forklift operating on the ground. EPA employees cannot relocate, unload, or load any other items on the van.

Similarly, for the return shipment of the engine to the manufacturer, the pickup van shall be constructed in such a manner to allow EPA to use a forklift operating from the ground to load the engine on the rear of the van. EPA employees cannot relocate, unload, or load any other items on the van.

3. To minimize breakage and pilferage, it is suggested that the manufacturer ship the engine covered by a preformed container which utilizes the pre-aligned engine stand (see Section I.A. of Appendix A) as its base, which does not interfere with usage of a forklift in loading, transporting, and unloading, and which is easy to remove and reinstall without being dismantled.

4. Copies of all information pertinent to the engine and required for testing shall be attached to the engine when it is delivered to EPA.

5. All hose, line and threaded fittings shall have protective caps and shall bear labels describing their function. EPA reserves the right to request the manufacturer to repair any unusable parts.

6. Drain "cocks" shall be provided and properly identified to insure complete drainage of coolant. Any special instructions for draining shall be provided with the engine.

7. Appendix A to this Advisory Circular explains in further detail what needs to be done to prepare engines for testing at the EPA laboratory.

8. Appendix B to this Advisory Circular is a set of drawings of the EPA engine test cells. These drawings will help manufacturers to familiarize themselves with the cell layout and to assure that all engine equipment is compatible with the location of EPA equipment in the cells.



Appendix A

Preparation of Heavy Duty Engines for EPA Testing

I. Pre-Aligned Stand and Driveshaft Adaptor Requirements

A. The manufacturer shall ship the engine on a pre-aligned stand (see drawings 1 and 1-A of Appendix B to this Advisory Circular).

1. Mounting of gasoline engines shall be 27 and 3/4 inches, as measured from the bedplate to the center of the driveshaft mounting point.

2. Mounting height of diesel engines shall be 35 and 5/8 inches as measured from the bedplate to the center of the driveshaft mounting point for the engine. (NOTE: Due to the incline angle required for the drive shaft alignment, this measurement is 5/8 inches more than the 35 inches from the centerline of dyno shaft to the bedplate on Drawings # 4B and # 4C of Appendix B.)

B. Driveshaft Adaptor Requirements

1. Both gasoline and diesel engines shall be equipped with flywheel, bellhousing and clutch assembly.

a. In the case of gasoline engines under 400 ft. lbs. torque, the pilot shaft shall terminate into a surface compatible with Drawing #3 of Appendix B.

b. In the case of gasoline engines over 400 ft. lbs. torque, the pilot shaft shall terminate into a surface compatible with Drawing #3A of Appendix B.

c. The termination of the pilot shaft for all diesel engines shall conform with Drawing #3A of Appendix B.

2. The clutch actuator and controls are not required under this item.

II. EPA Interface Requirements for Gasoline Engines

A. Fitting Requirements

1. Oil pressure shall terminate in a 1/4 inch female pipe fitting (N.P.T.).

2. Intake manifold vacuum connection shall terminate in a 1/4 inch female pipe fitting (N.P.T.).

3. All water inlets shall terminate into a single 2 and 1/4 inches O. D. inlet connection.

4. All water outlets shall terminate into a single 2 and 1/4 inches O. D. outlet connection.

5. Fuel inlet connection shall terminate in a 1/2 inch female pipe fitting (N.P.T.).

B. Other Requirements

1. All thermocouples shall be a minimum of 8 feet long and terminate in an iron-constantine male J plug (Honeywell No. 728096-1 or equivalent).

2. Exhaust system shall be compatible with equipment in drawings 2 and 2-A of Appendix B to this Advisory Circular.

3. Sample probe shall be installed as required in 40 CFR 85.774-13(b)(24) and terminate in a 3/8 inch tube fitting.

III. EPA Interface Requirements for Diesel Engines

A. Fitting Requirements

1. Oil pressure connection shall terminate in a 1/4 inch female pipe fitting (N.P.T.).

2. Inlet restriction connection shall be installed appropriately and terminate in a 1/4 inch female pipe fitting (N.P.T.).

3. Connection for setting exhaust back pressure shall be installed appropriately and terminate in a 1/4 inch female pipe fitting (N.P.T.).

4. All water inlets shall terminate into a single 2 and 1/4 inches O. D. inlet connection.

5. All water outlets shall terminate into a single 2 and 1/4 inches O. D. outlet connection.

6. Fuel inlet connection shall terminate into a 1/2 inch female pipe fitting (N.P.T.); fuel return connection shall be of the same dimension.



B. Other Requirements

1. All thermocouples shall be a minimum of 8 feet long and terminate in an iron-constantine type J plug. (Honeywell No. 728096-1 or equivalent).
2. Exhaust system shall be compatible with equivalent in drawings 4, 4-A, and 4-B of the Appendix B to this Advisory Circular.
3. A 100-volt (AC) or 12-volt (DC) control appropriately installed to provide instantaneous shutoff for emergency situations. The "no-power" position of the control shall be "off".
4. Sample probe shall be installed as specified in Sections 2.1 and 2.2 of SAE Recommended Practice No. J215 entitled "Continuous Hydrocarbon Analysis of Diesel Exhaust", dated November 1970, and terminates in a 3/8 inch tube fitting.
5. Means to control the exhaust back pressure shall be provided as necessary by the manufacturer.
6. EPA will be attaching (approximately parallel to the bedplate) restrictor and laminar flow equipment to the air intake unit(s). The restrictor and laminar flow equipment requires clearance for a 6 inch radius and a 5 foot length. The manufacturer shall assure that no engine components will interfere with the equipment or hinder its installation as described. The manufacturer shall examine drawings 4, 4-A, 4-B, and 5 and the photographs in Appendix B to assure the air intake unit(s) are located so as to allow installation of this restrictor and laminar flow without interference from other EPA equipment in the cell. The manufacturer shall terminate the air intake unit(s) in an adaptor plate(s) to conform to drawing 5 of Appendix B to this Advisory Circular.

Appendix B

SMALL H.D. ENGINE STAND

Note

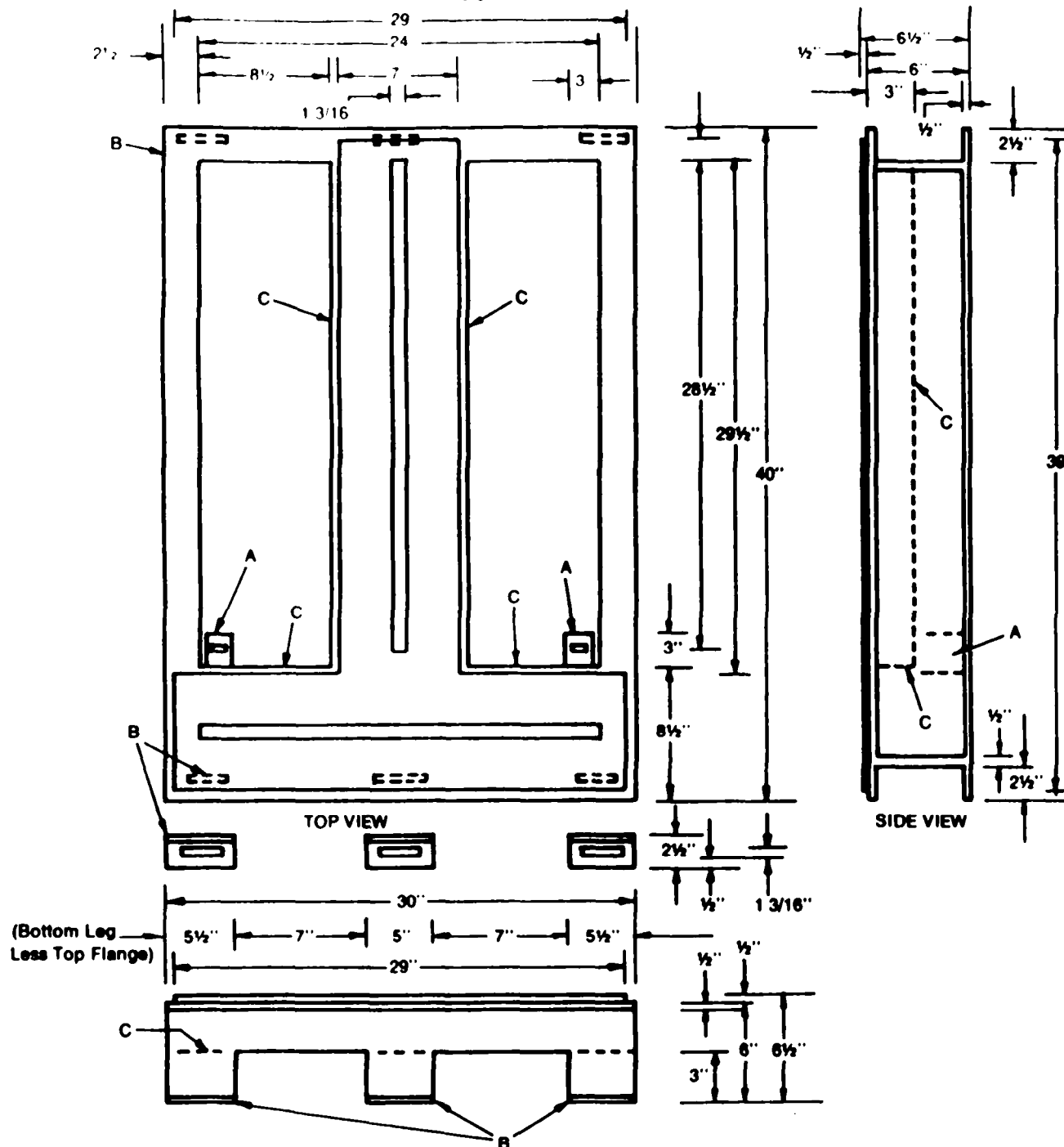
A 3" angle with 2½" x 1 3/16" T-slot, 2-places only, bottom of stand

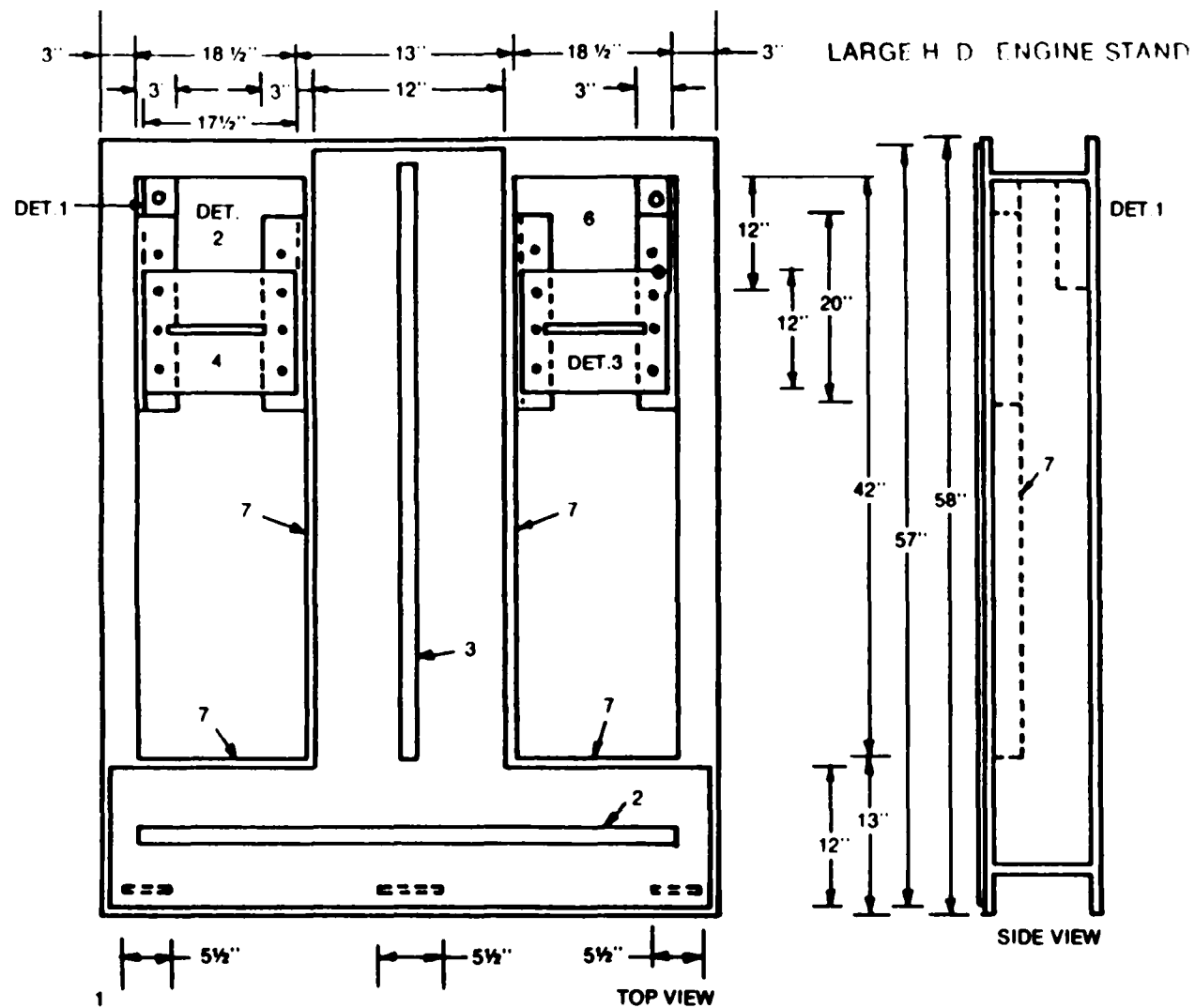
B 2½" x 1 3/16" slot in each leg, both ends, 3-legs each end

C 3" Gusset (welded) to support T-slot plates

Mat'l.— "C" channel, ½" THK, 2½" wide, 6" HIGH; T-slot Plate is ½" THK, welded on. T-slots are 1 3/16" wide, MILD STL.

Note: Not to Scale





Note

1. T-Bolt Slot, 5 1/2" x 1 1/4" w. both ends
2. T-Bolt Slot, 41" x 1 1/4" w
3. T-Bolt Slot, 49" x 1 1/4" w
- 4 T-Bolt Slot, 12" x 1 1/4" w
- 5 Material - mild steel, C - channel
- 6 DET. 2 & DET. 3 Req'd only when 4 - point mounting is used
- 7 3" Gusset welded to support T-Slot plates

DET. 1

3" x 3" x 12" Angle
welded to inside of
"C-channel" at bottom
(2) 1 1/2" dia. hole on C/L
spaced 6" apart.

DET. 2

3" x 3" x 20" Angle
welded to inside of
"C-channel" at top
(6) 1/2" dia. holes on C/L
spaced 3" apart.

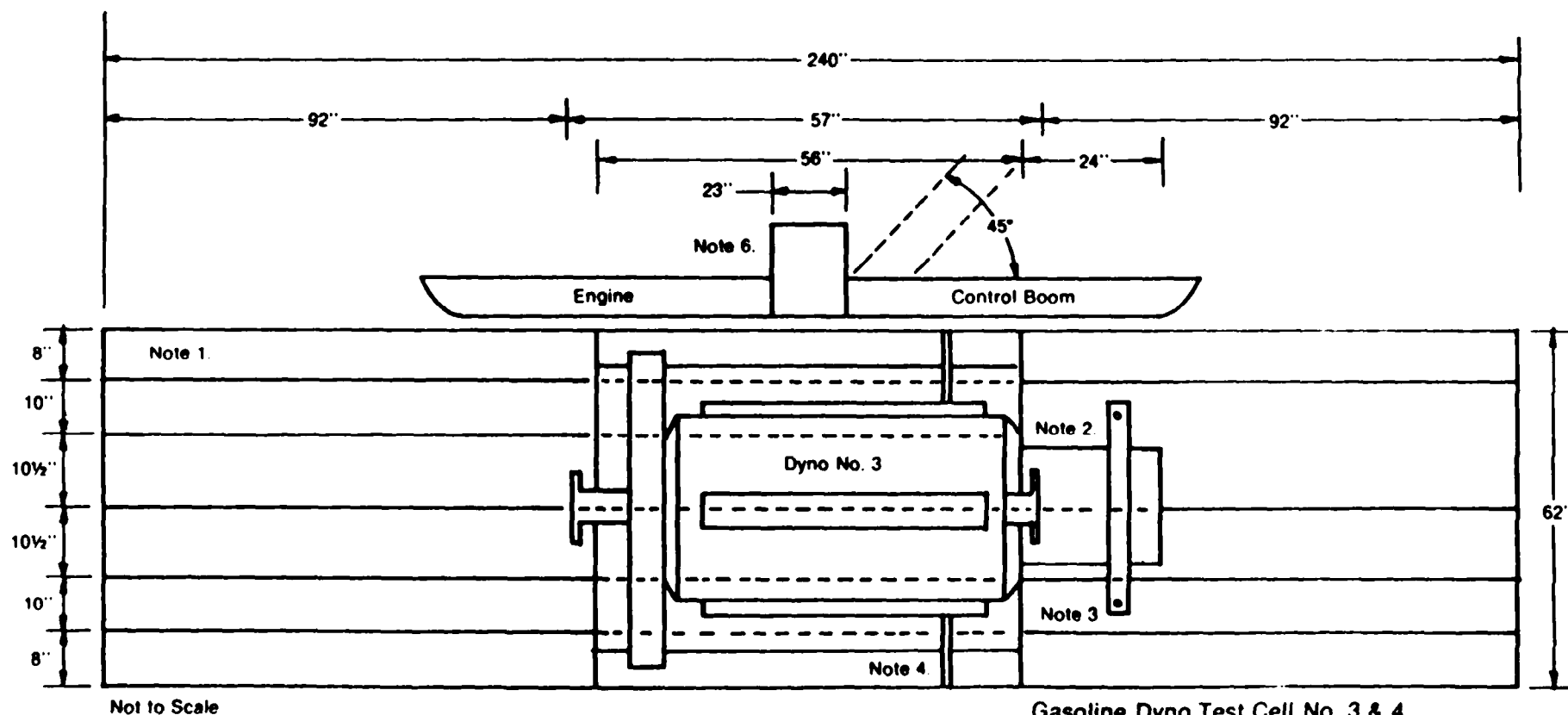
DET. 3

12" x 17 1/2" x 1/2" Plate bolts
to angles (4) 1/2" dia. holes
spaced 3" apart to
match DET. 2

Not to Scale

Note

- 1 Bed Plate "T-slots" -2" wide at bottom, 1" wide at top, full length of bed plate.
2. Drive shaft guard - 24" long x 7½" wide.
3. Accelerator Actuator Stand - 7" x 27½"; Height adjustable from 40½", min.
4. Exhaust Pipe(s) must be at an angle that will clear drive shaft guard, accelerator actuator stand, dynamometer base, and torque arm.
5. Drive shaft length - 26" min. - 29" max.
- 6 Dyno test cell no. 4 is identical to No. 3 except engine control boom is on the opposite side.
7. Overhead exhaust stack not shown.



TOP VIEW

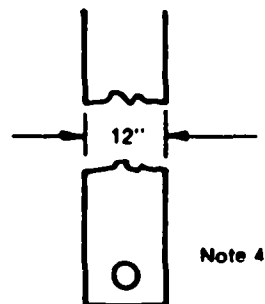
Gasoline Dyno Test Cell No. 3 & 4

Note

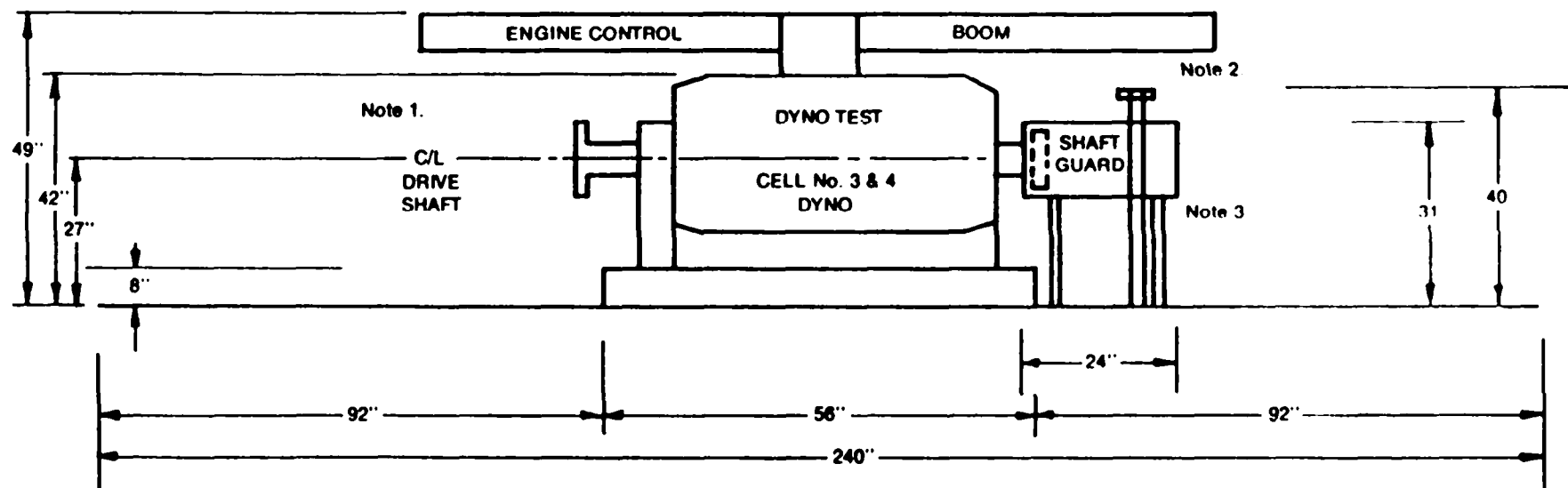
1. C/L of Drive Shaft - 27" above Bed Plate.
2. Accelerator Actuator Stand can be on either end of engine.
3. Drive shaft guard is only 12" long when clutch bell housing is affixed to engine (with or without clutch).
4. Overhead exhaust stacks fitted with (2) exhaust ports to connect to 3" I.D. Marmon clamps.

GASOLINE DYNO TEST CELL NO 3 & 4

SIDE VIEW



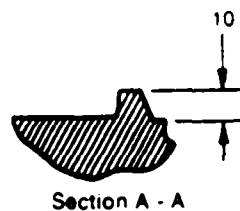
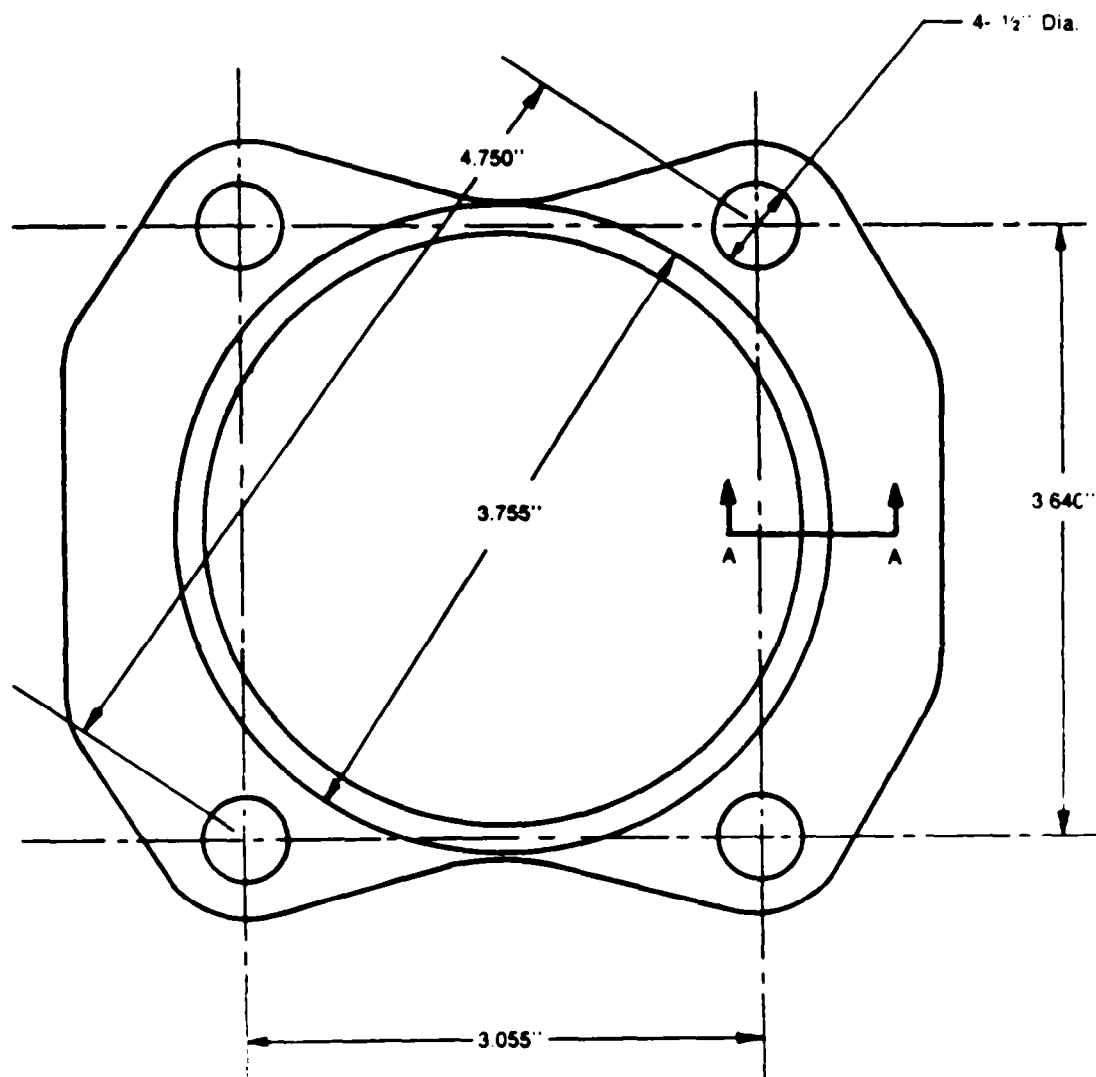
Note 4.



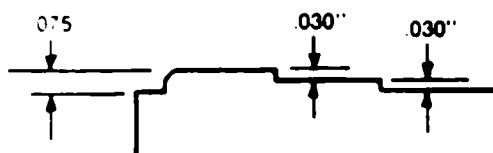
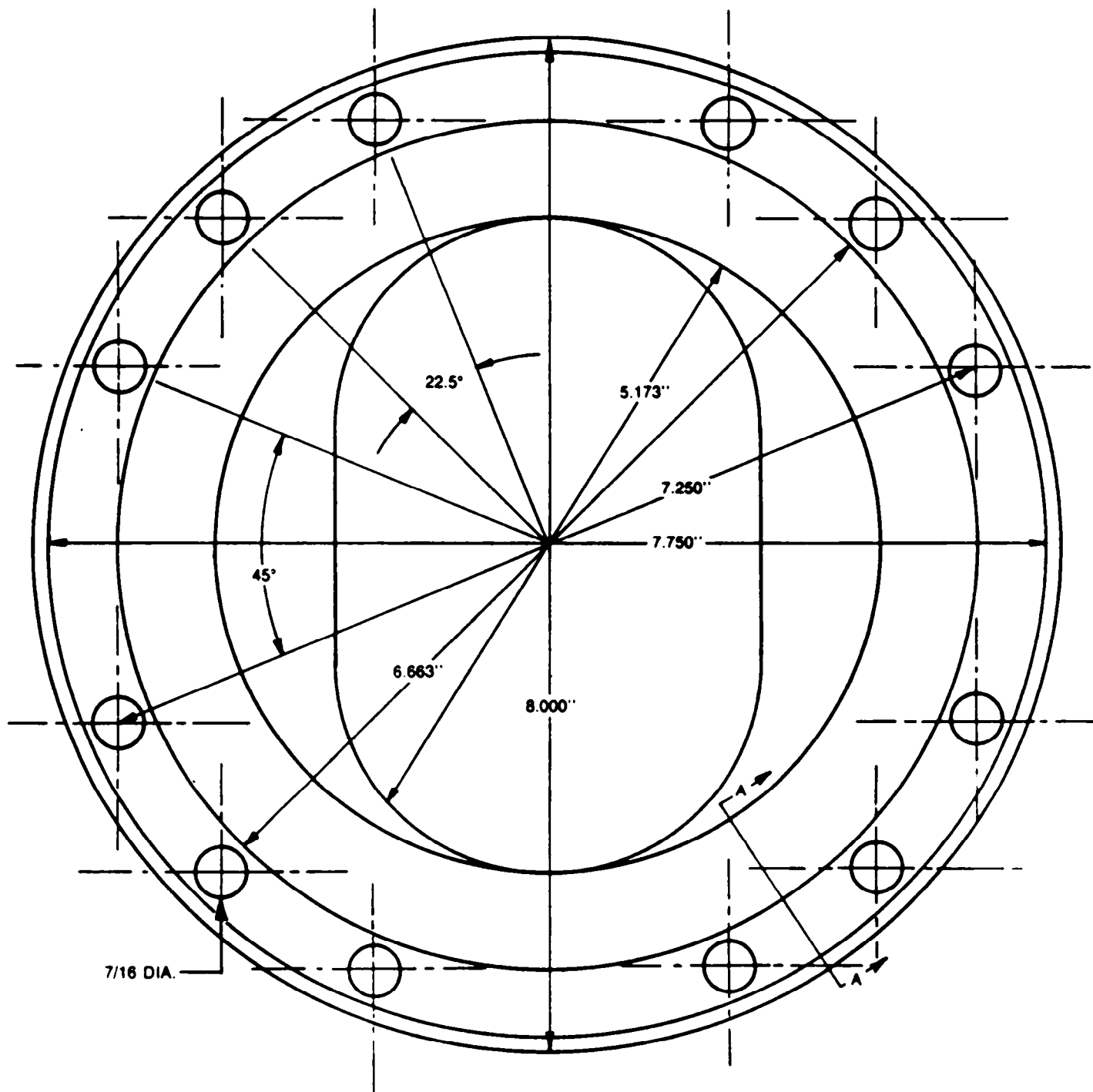
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Drawing # 2 - A

DYNAMOMETER DRIVE SHAFT BOLT PATTERN



EPA DRIVESHAFT BOLT PATTERN



SECTION A - A

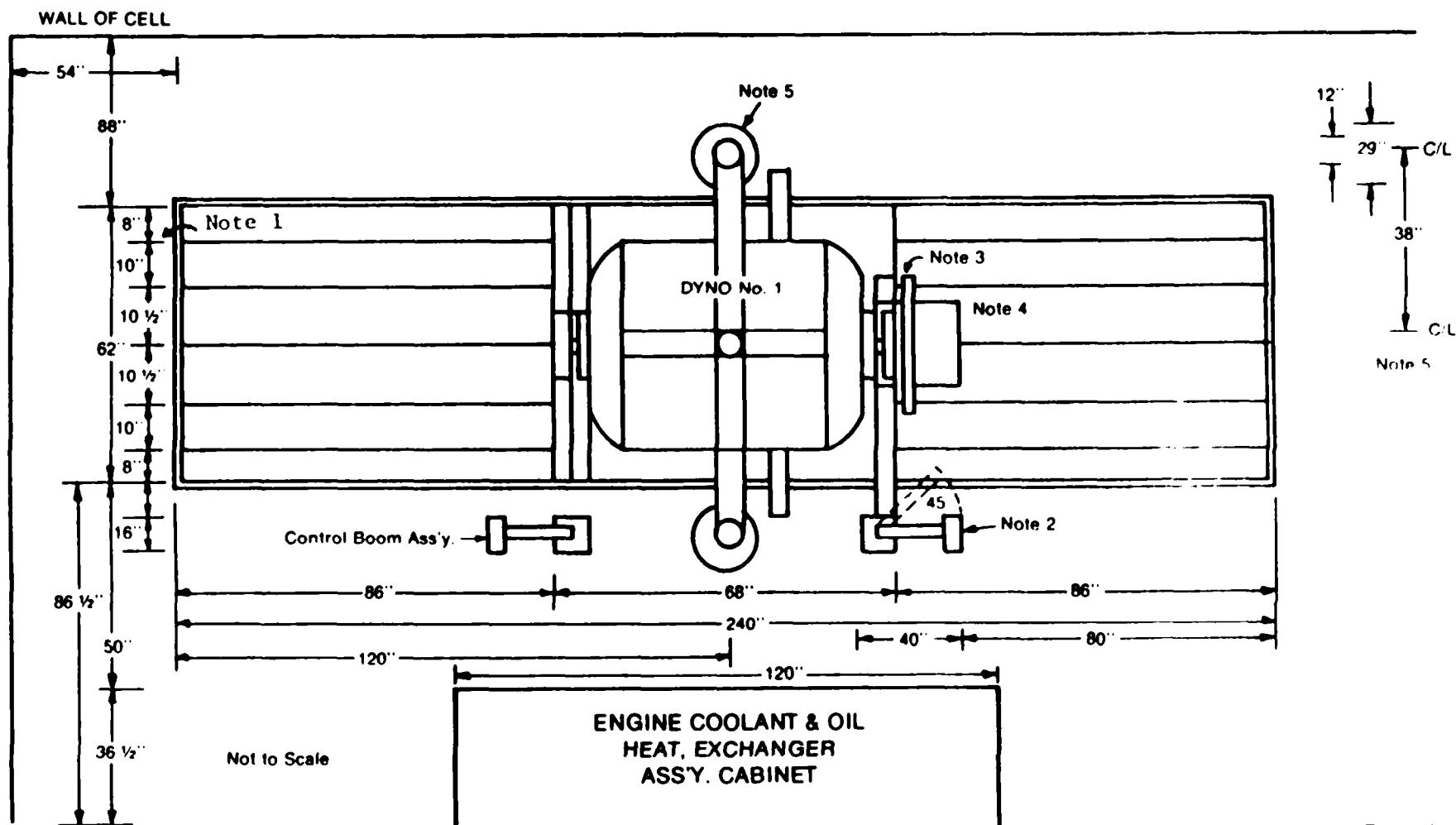
**Diesel Engine and
Gasoline over 400 FT Pound
Torque**

Drawing # 3 A

Note

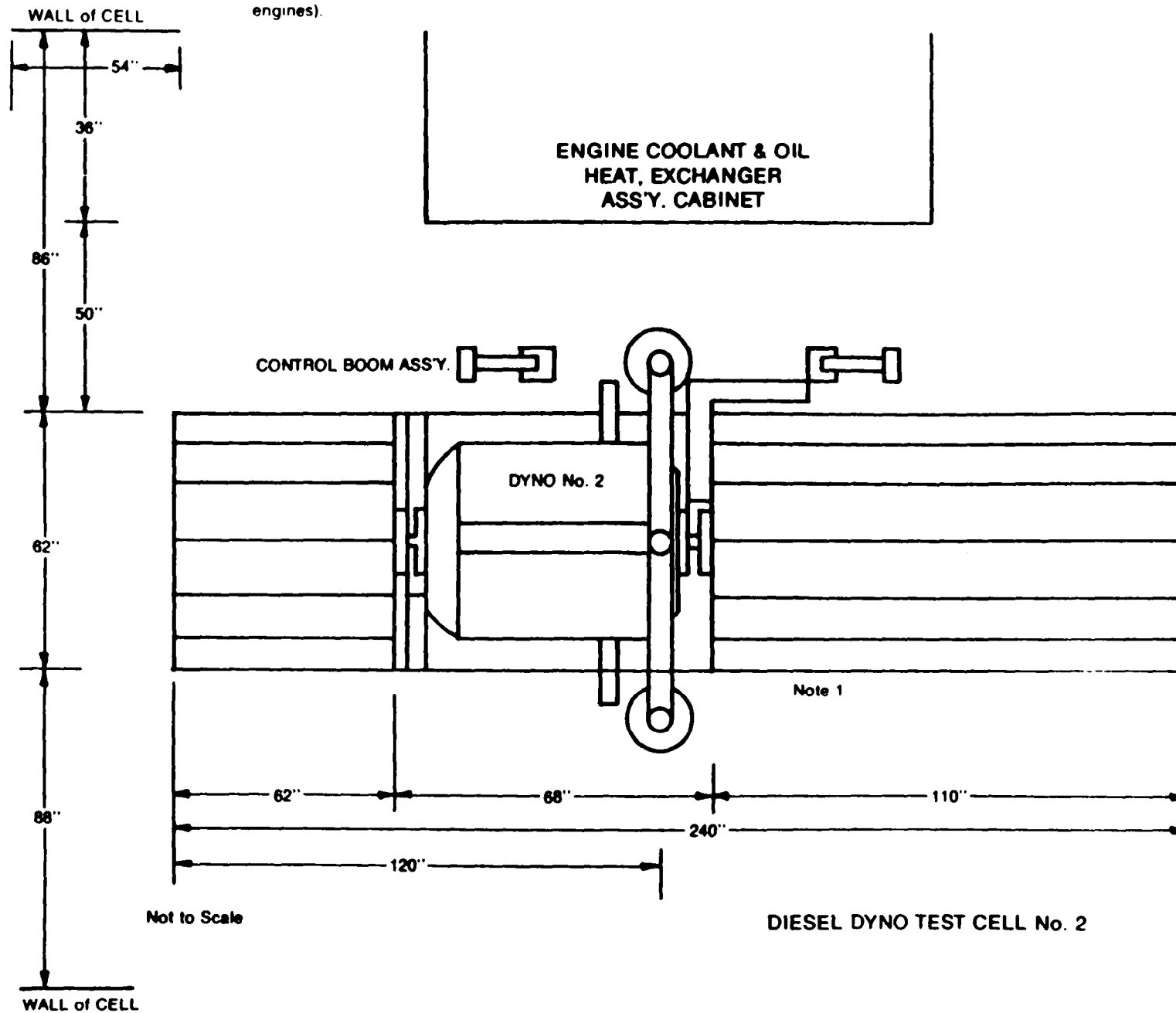
1. T-Slots - 1" wide at top, 2" wide at bottom, full length of Bed Plate
2. Control Boom Ass'y. (2) at each end of Dyno Swivels 45° both directions.
3. Accelerator actuator stand - 28" x 6" w x 40" h. min.
4. Drive Shaft Protective Cover, 13" dia., angular adj. from horiz. either end; 24" long; vert. adj. - 34 3/4" min. 41 1/2" max.
5. Exhaust stack to ceiling - 12" dia. Hood base - 29" dia. both sides of Dyno.

DIESEL DYNO TEST CELL No. 1



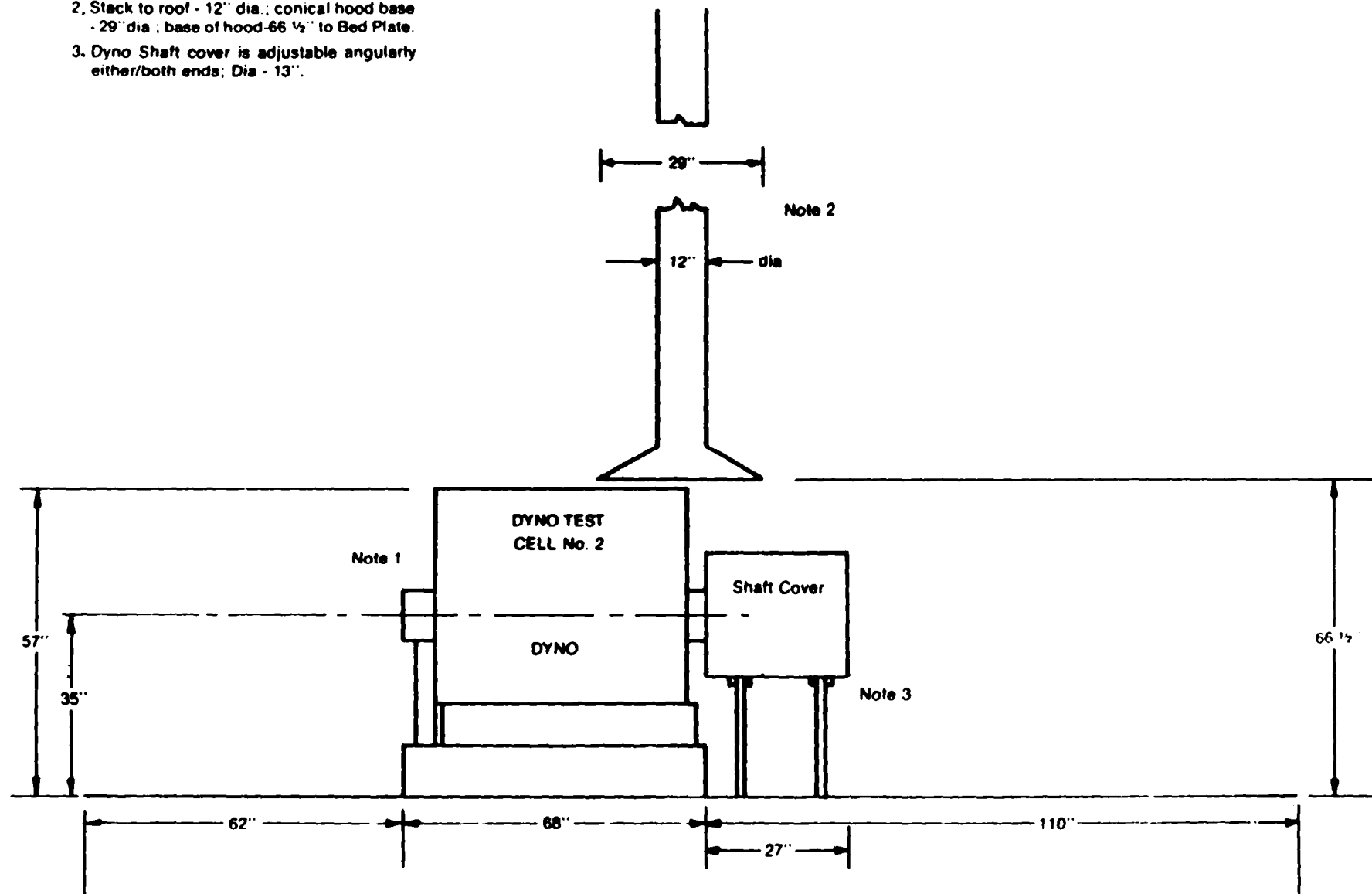
Note

- 1 All dimensions the same as on Drawing # 4 except the location of the Dyno on the Bed Plate (to accommodate large engines).

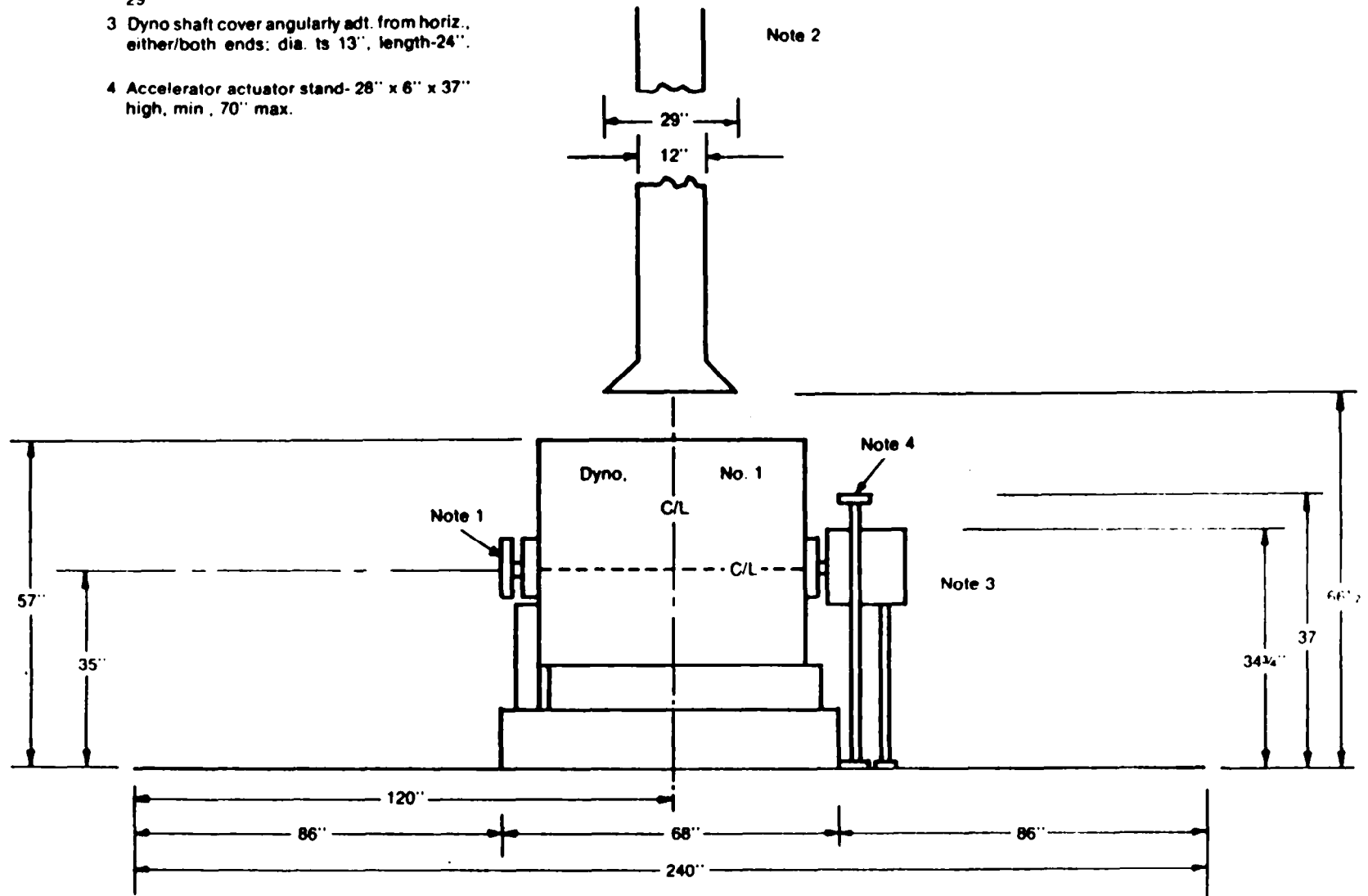


Note

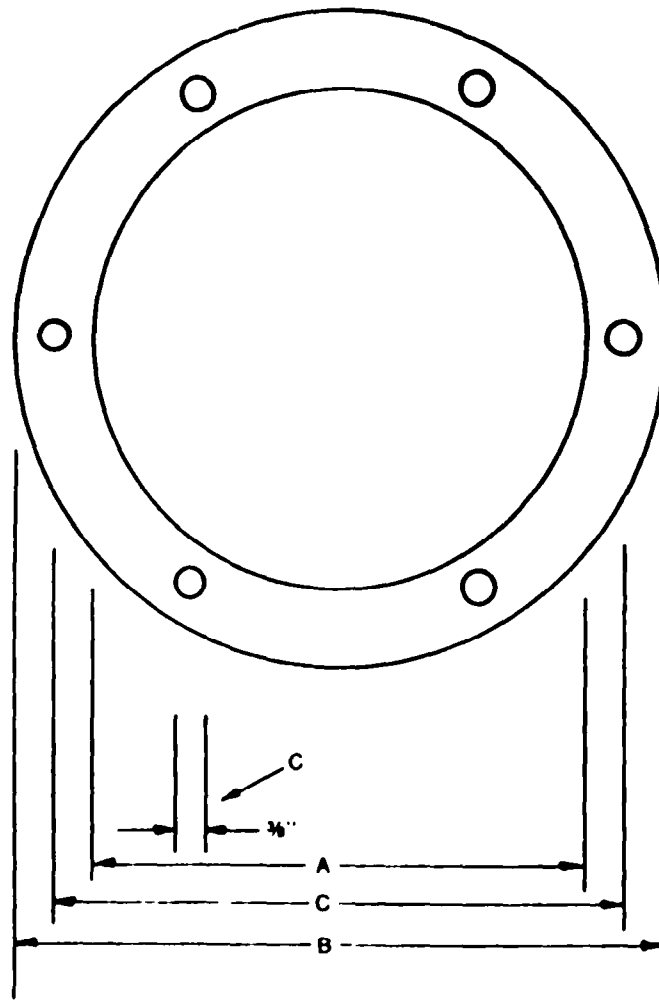
1. C/L of Dyno Shaft to base plate - 35"
2. Stack to roof - 12" dia.; conical hood base - 29" dia.; base of hood - 66 1/2" to Bed Plate.
3. Dyno Shaft cover is adjustable angularly either/both ends; Dia - 13".



- 1 Centerline of dyno shaft to bed plate -35"
- 2 Stack to roof-12" dia. conical hood base-29"
- 3 Dyno shaft cover angularly adj. from horiz., either/both ends; dia. ts 13", length-24"
- 4 Accelerator actuator stand- 28" x 6" x 37" high, min. , 70" max.



Intake Flange Mounting Adaptor for Laminar Flow Clean Room

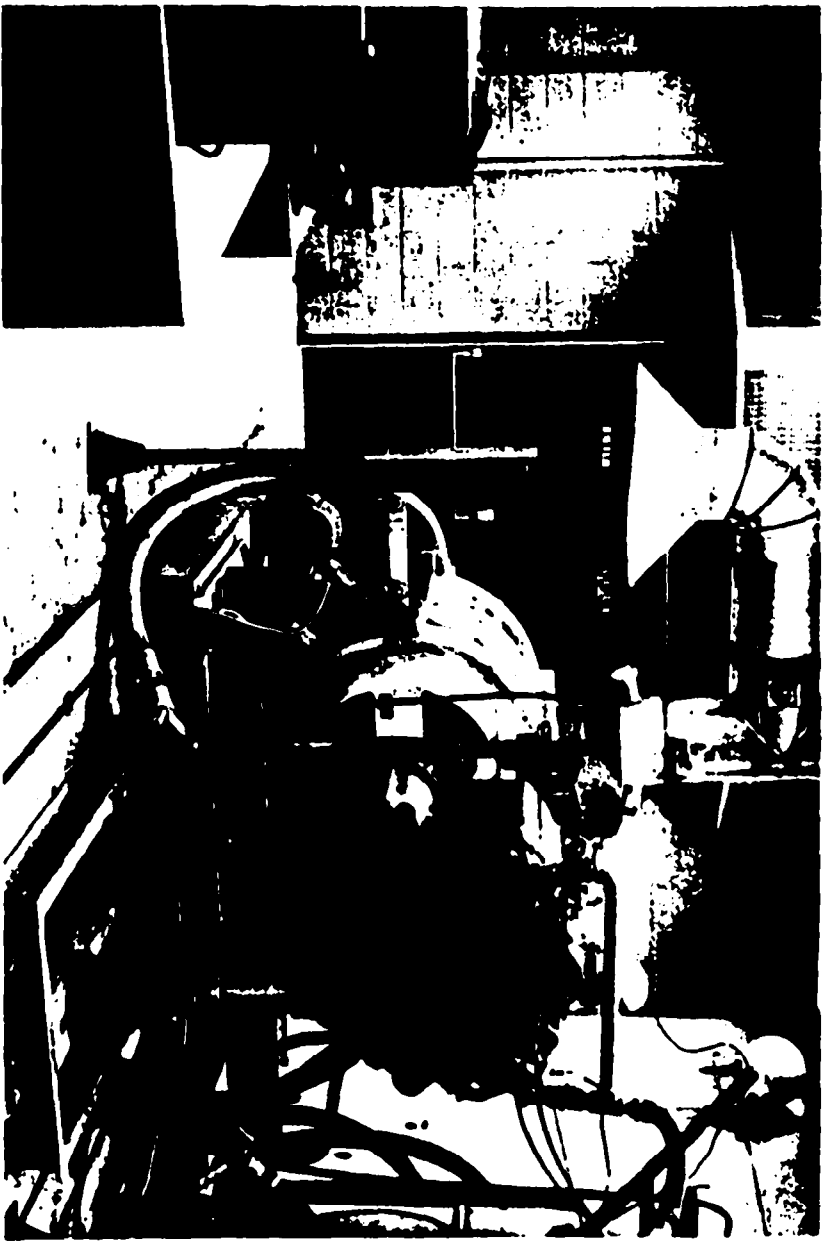


- A Dia. of 6" for Diesel Engines with Air Intake Flow of 500 CFM, or less. Dia. of 8" for Diesel Engines with Air Intake flow of 501 to 1000 CFM
- B O.D. of 8" for 6" I.D. O.D. of 10" for 8" I.D.
- C Six (6) 3/8" dia. holes. EQUI-distant from each other on 7" Bolt Circle for 6" I.D., 9" Bolt Circle for 8" I.D. (Drilled and Reamed)

Material: Mild Steel or Aluminum 1/2" or 3/4" thick
Remove all burrs

Tolerances $\pm .003$

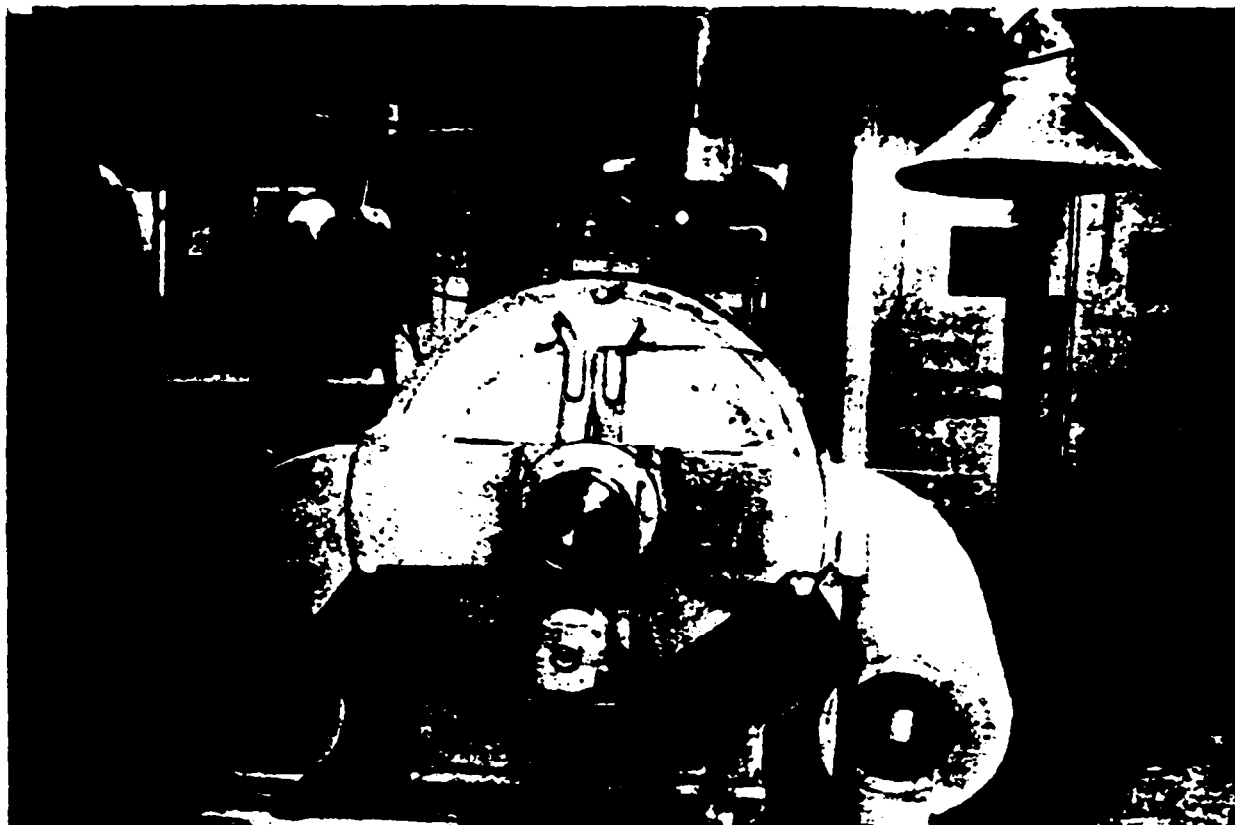
Note: Not to scale



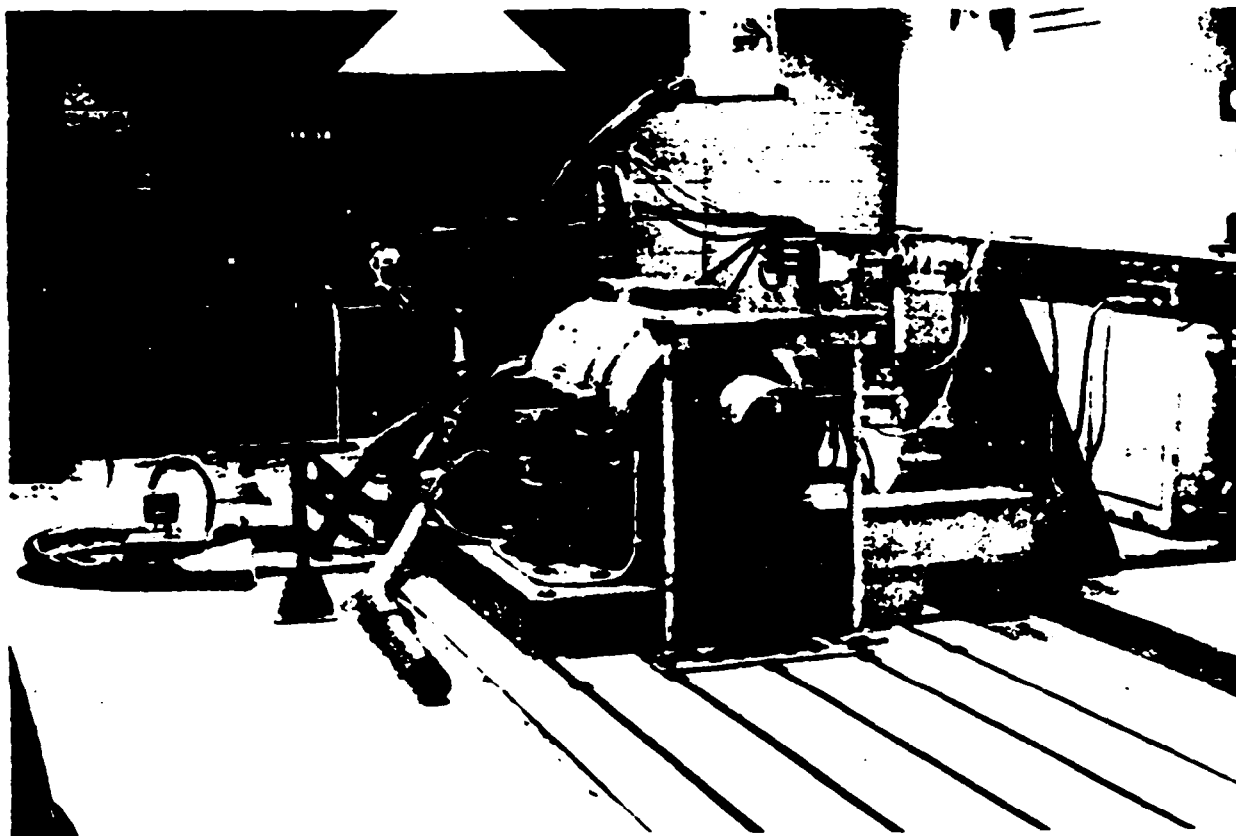
LEFT FRONT VIEW - DIESEL TEST CELL, NO. 2.



RIGHT FRONT VIEW - DIESEL TEST CELL, NO. 1.



REAR VIEW - DIESEL TEST CELL, NO. 2.



LEFT FRONT VIEW - GASOLINE TEST CELL, NO. 4.